

U.S. Application No. 09/973,228 – Filed: October 9, 2001
Supplemental Amendment Dated: November 24, 2004
Reply to Office Action Dated: July 29, 2004

Amendments to the Specification:

Please replace the paragraph beginning at page 1, line 6, with the following rewritten paragraph:

U.S. Patent Application Serial No. 09/[_____] 973,239, entitled INK JET PROCESS INCLUDING REMOVAL OF EXCESS LIQUID FROM AN INTERMEDIATE MEMBER by Thomas N. Tombs Arun Chowdry, et al., (~~Docket 81,459/LPK~~), and

Please replace the paragraph beginning on page 1, line 10, with the following rewritten paragraph:

U.S. Patent Application Serial No. 09/[_____] 973,244, entitled INK JET IMAGING VIA COAGULATION ON AN INTERMEDIATE MEMBER by John W. May, et al. (~~Docket 81,460/LPK~~), concurrently filed herewith, the disclosures of which are incorporated herein.

Please remove the blank line on page 1, line 14.

Please remove the blank line on page 1, line 22.

Please replace the paragraph beginning on page 2, line 25, with the following rewritten paragraph:

In related copending U.S. Patent Application Serial No. 09/[_____] 973,244, entitled *Ink Jet Imaging Via Coagulation On An Intermediate Member* (~~Docket 81,460/LPK~~) by John W. May, et al., the contents of which are incorporated herein by reference, certain embodiments are disclosed for using an ink jet device to form an ink image on an intermediate member, which ink is an electrocoagulable ink. By jetting a predetermined variable number of droplets on each imaging pixel of an operational surface of the intermediate member, the resulting ink image on the intermediate member has a predetermined variable amount of coagulable ink per pixel. The ink image is moved into contact with an electrocoagulation member, which electrocoagulation member makes physical contact

with the variable amounts of liquid of the ink jet image on the intermediate member. Passage of electric current between an electrode included in the electrocoagulation member and a sub-surface electrode included in the intermediate member results in passage of corresponding currents through the variable amounts of electrocoagulable ink, thereby causing an imagewise formation of coagulate deposits on the intermediate member. An excess liquid phase not included in the coagulate deposits is removed from the coagulate deposits while the coagulate deposits remain on the intermediate member, and the coagulate deposits are subsequently transferred to a receiver member. There are certain limitations, which may be associated with the above-described embodiments. These limitations include: (1) a difficulty associated with providing a small enough gap, between the operational surface of the intermediate member and the electrocoagulation member, so that every differing amount of electrocoagulable ink in the ink image can be contacted by the electrocoagulation member, i.e., so that electrocoagulation can occur efficiently at every imaging pixel where there is ink; (2) if, in fact, the gap is made thus sufficiently small, there is a difficulty with a possible blurring of the image as a result of a squashing of the larger amounts of the variable amounts of ink; (3) after the coagulate deposits are formed on the intermediate member, there is a difficulty in efficiently removing the corresponding variable amounts of excess liquid phase from the coagulate deposits; (4) owing to a varying thickness from pixel to pixel of the coagulate deposits, a high efficiency of transfer to a receiver of the thinnest of such deposits may be difficult to achieve.

Please replace the paragraph beginning on page 3, line 27, with the following rewritten paragraph:

In related copending U.S. Patent Application Serial No. 09/[_____] 973,239, entitled *Ink Jet Process Including Removal Of Excess Liquid From An Intermediate Member (Docket 81,459/LPK)* by Thomas N. Tombs Arun Chowdry, et al., the contents of which are incorporated herein by reference, certain embodiments are disclosed for using an ink jet device to form a colloidal ink image on an intermediate member, which ink is nonaqueous colloidal dispersion of electrically charged pigmented particles in an insulating carrier liquid, similar to a

liquid developer for use in electrostatography. By jetting a predetermined variable number of droplets on each imaging pixel of an operational surface of the intermediate member, the resulting colloidal ink image on the intermediate member has a predetermined variable amount of colloidal dispersion per pixel. In one of the disclosed embodiments, the colloidal ink image is moved into proximity with an electrode member, which electrode member makes physical contact with the variable amounts of liquid of the ink jet image on the intermediate member. An electric field applied between an electrode included in the electrocoagulation member and a sub-surface electrode included in the intermediate member urges the charged particles of the dispersion to form a concentrated image on the operational surface of the intermediate member. An excess carrier liquid not included in the concentrated image is removed from the concentrated image while the particles remain on the intermediate member, and the particles thus left behind on the operational surface are subsequently transferred to a receiver member. In other disclosed embodiments, the electrode member does not touch the ink image, and in yet other disclosed embodiments, a corona charging device is used to charge the variable amounts of liquid in the ink image, thereby producing internal electric fields within the variable amounts of liquid for urging the corresponding charged particles in each imaging pixel to migrate to the operational surface. There are certain limitations, which may be associated with one or more of the above-described embodiments. These limitations include: (1') a difficulty associated with providing a small enough gap, between the operational surface of the intermediate member and a contacting electrode member, so that every differing amount of ink in the ink image can be contacted by the contacting electrode member, i.e., so that particle migration can occur efficiently at every imaging pixel where there is ink; (2') if, in fact, the gap is made thus sufficiently small, there is a difficulty with a possible blurring of the image as a result of a squashing of the larger amounts of the variable amounts of ink; (3') after the concentrated image is formed on the intermediate member, there is a difficulty in efficiently removing the corresponding variable amounts of excess carrier liquid; (4') owing to a varying thickness from pixel to pixel of the deposits of migrated particles, a high efficiency of transfer to a receiver of the thinnest of such deposits may be difficult to achieve.

Please remove the blank line on page 5, line 5.

Please remove the blank line on page 7, line 18.

Please remove the blank line on page 9, line 21.

Please replace the paragraph beginning on page 16, line 16, with the following rewritten paragraph:

In another embodiment (not illustrated) a marking electrocoagulable ink and a non-marking electrocoagulable ink are used to jointly form a primary image, the non-marking coagulable ink containing a coagulable material by analogy with Fig. [2]1d. Thus, the marking electrocoagulable ink provides a colored electrocoagulate component deposited on the operational surface of the intermediate member, and the non-marking electrocoagulable ink provides a complementary amount of co-deposited, substantially uncolored, electrocoagulate. Preferably, in each imaging pixel an amount of colored electrocoagulate and a complementary amount substantially uncolored electrocoagulate together form an intimately mixed co-electrocoagulate on the operational surface. In this other most preferred embodiment, in similar fashion to the embodiments of Fig. 1, the total volume of liquid is made substantially the same in each imaging pixel of the primary image, which total volume per pixel includes both any marking electrocoagulable ink and any intermixed preferably miscible non-marking electrocoagulable ink. This is accomplished by delivering from the first and second sources of ink an appropriate number of droplets of each of the first and second electrocoagulable inks per pixel, so as to produce in a constant total volume per pixel of the primary image a required predetermined proportion of the marking electrocoagulable coagulable ink. Generally, according to the invention, a ~~co-electrocoagulate~~ coelectrocoagulate is formed adjacent the operational surface in any given imaging pixel. Preferably, such a co-electrocoagulate is a uniform mixture of the marking and non-marking electrocoagulates contained in the given pixel. However, in certain embodiments, a stratified co-electrocoagulate material or a nonuniformly mixed co-electrocoagulate

material may be usefully formed adjacent the operational surface of the intermediate member.

Please replace the paragraph beginning on page 23, line 16, with the following rewritten paragraph:

In the Excess Liquid Removal Process Zone 13, excess liquid is removed from the coagulates formed in the Coagulate Formation Process Zone 12. In general, a portion, preferably a major portion, of the liquid is removed from the coagulates so as to form a liquid-depleted image, which liquid-depleted image can in certain cases retain a significant amount of residual liquid. In certain circumstances substantially all of the liquid may be removed to form the liquid-depleted image. Excess Liquid Removal Process Zone 23 includes an excess liquid removal device, which is any of the following known devices: a squeegee (roller or blade), an external blotter device, an evaporation device, a vacuum device, a skiving device, and an air knife device. These excess liquid removal devices are described more fully in related copending U.S. Patent Application Serial No. 09/[_____] 973,239, entitled *Ink Jet Process Including Removal Of Excess Liquid From An Intermediate Member* (~~Docket 81,459/LPK~~) by Thomas N. Tombs Arun Chowdry, et al., and related copending U.S. Patent Application Serial No. 09/[_____] 973,244, entitled *Ink Jet Imaging Via Coagulation On An Intermediate Member* (~~Docket 81,460/LPK~~) by John W. May, et al. Any other suitable excess liquid removal device or process may be used.

Please replace the paragraph beginning on page 24, line 3, with the following rewritten paragraph:

Transfer Process Zone 24 for transferring an ink-jet-ink-derived material image from intermediate member (IM) 28 to a receiver member includes any known transfer device, e.g., an electrostatic transfer device, a thermal transfer device, and a pressure transfer device, such as described fully in related copending U.S. Patent Application Serial No. 09/[_____] 973,239, entitled *Ink Jet Process Including Removal Of Excess Liquid From An Intermediate Member* (~~Docket 81,459/LPK~~) by Thomas N. Tombs Arun Chowdry, et al., and related copending U.S.

Patent Application Serial No. 09/[] 973,244, entitled *Ink Jet Imaging Via Coagulation On An Intermediate Member* (~~Docket 81,460/LPK~~) by John W. May, et al. As is well known, both an electrostatic transfer device and a thermal transfer device can be used with an externally applied pressure. An electrostatic transfer device for use in Transfer Process Zone 24 typically includes a backup roller (not shown), which backup roller is electrically biased by a power supply (not shown). The backup roller co-rotates in a pressure nip relationship with IM 28, and a receiver member such as sheet 29a is translated through the nip formed between the backup roller and IM 28. An ink-jet-ink-derived material image carrying an electrostatic net charge is transferable by an electrostatic transfer device from IM 28 to the receiver, i.e., an electric field is provided between IM 28 and the backup roller to urge transfer of the ink-jet-ink-derived material image. For use to augment electrostatic transfer when an ink-jet-ink-derived material image on IM 28 has a low electrostatic charge or is uncharged, a charging device (not shown) such as for example a corona charger or a roller charger or any other suitable charging device may be located between Excess Liquid Removal Process Zone 23 and Transfer Process Zone 24, which charging device may be used to suitably charge the ink-jet-ink-derived liquid-depleted material image prior to subsequent electrostatic transfer of the material image in Transfer Process Zone 24. Alternatively, a thermal transfer device may be used to transfer the ink-jet-ink-derived material image, which thermal transfer device can include a heated backup roller (not shown), which backup roller is heated by an external heat source such as a source of radiant heat or by a heated roller (not shown) contacting the backup roller (not shown). Alternatively, the backup roller for thermal transfer can be heated by an internal source of heat. The backup roller for thermal transfer co-rotates in a pressure nip relationship with IM 28, and a receiver member such as sheet 29a is translated through the nip formed between the heated backup roller and IM 28. In certain embodiments, IM 28 may be similarly heated, either from an internal or external source of heat. As an alternative, a thermal Transfer Process Zone 24 may include a transfusing device, wherein an ink-jet-ink-derived material image is thermally transferred to and simultaneously fused to a receiver. As yet another alternative, a pressure transfer device may be used in Transfer Process Zone 24 to transfer an ink-jet-ink-derived material image, which pressure transfer device includes

a backup pressure roller (not shown) which pressure roller co-rotates in a pressure nip relationship with IM 28, and a receiver member such as sheet 19a is translated through the nip formed between the pressure backup roller and IM 28. In such a pressure transfer device, an adhesion of the ink-jet-ink-derived material image is preferably much greater on the surface of the receiver than on the operational surface of IM 16, and preferably the adhesion to the operational surface of IM 16 is negligible.

Please replace the paragraph beginning on page 47, line 11, with the following rewritten paragraph:

In yet other embodiments of the invention (not illustrated), alternative mechanisms other than electric field mechanisms are used to cause formation of coagulates in the Coagulate Process Formation Zone 22. As for certain previous embodiments described above, in certain of these yet other embodiments one of the first and second inks used in the ink jet device 21 is a marking ink, which marking ink is preferably a dispersion of colored, preferably pigmented, particles in a carrier liquid, the other ink containing no particles and preferably being otherwise similar to the carrier liquid of the marking ink. However, in preferred embodiments of these yet other embodiments, both the first and second inks are dispersions of particles in a respective carrier liquid, one of the inks being a dispersion of marking particles which particles are preferably pigmented particles, and the other ink being a dispersion of non-marking, preferably colorless, unpigmented, particles. In these preferred yet other embodiments, an amount of coagulated material produced from each pixel of the primary image in the Coagulate Process Formation Zone 22 is preferably substantially uniform for all pixels of an image, which amount includes imagewise varying complementary amounts of both marking and non-marking particles, wherein some pixels contain only marking particles and some pixels contain only non-marking particles, as fully described above for previous embodiments. To cause formation of coagulates in a primary image by any of the alternative mechanisms described below, complementary volumes of the marking and non-marking inks are co-deposited by the ink jet device 21 so as to preferably produce substantially the same total volume of liquid in each pixel of the primary image, wherein some pixels contain only the

marking ink and some pixels contain only the non-marking ink. These alternative mechanisms for forming coagulates in a primary image include mechanisms for forming coagulates as disclosed in the above-referenced related co-pending US Patent Application Serial No. [] 09/973,244 filed on even date herewith in the names of [] John W. May, et al. The term "coagulate", as used hereafter in the following descriptions of these alternative mechanisms, includes flocs, aggregates, or agglomerates.

Please replace the paragraph beginning on page 53, line 9, with the following rewritten paragraph:

The present invention has certain advantages over the inventions disclosed in related copending U.S. Patent Application Serial No. 09/[] 973,239, entitled *Ink Jet Process Including Removal Of Excess Liquid From An Intermediate Member* (~~Docket 81,459/LPK~~) by ~~Thomas N. Tombs~~ Arun Chowdry, et al., and related copending U.S. Patent Application Serial No. 09/[] 973,244, entitled *Ink Jet Imaging Via Coagulation On An Intermediate Member* (~~Docket 81,460/LPK~~) by John W. May, et al. An important feature of the present invention is that a substantially constant volume of liquid is preferably deposited in each pixel of a primary image by the ink jet device, which liquid includes at least one of the marking and non-marking inks. By comparison with art wherein only marking ink is used to form a primary image, in the present invention problems are much reduced relating to image spreading during formation of the primary image by the ink jet device. Similarly, by comparison with other art wherein only marking ink is used to form a primary image, problems are much reduced relating to image spreading during the removal of excess liquid (prior to transfer of an ink-jet-ink-derived material image to a receiver). When only one ink is used, different pixels of a primary image contain variable numbers of droplets, and there is a problem of sideways squashing of the liquid in those pixels containing larger volumes ink when a contacting device is used to remove the excess liquid, resulting in reduced image sharpness and resolution. In relation to these problems, the present invention is advantageously not as dependent on surface energies and spreading coefficients to maintain image integrity against image spreading. Moreover, because each pixel of the primary image contains

preferably substantially the same volume of liquid, it is easier to provide a uniform spacing for a noncontacting electrode or to provide a more uniform current density in an electrocoagulable primary image. In preferred embodiments in which the non-marking ink is a dispersion of preferably colorless or unpigmented particles, it is easier to remove excess liquid using a contacting excess liquid removal device, inasmuch as an amount of excess liquid is preferably substantially the same in each pixel after coagulates have been formed. Similarly, in preferred electrocoagulation embodiments in which the non-marking ink is made of a preferably colorless or unpigmented electrocoagulable material, it is easier to remove excess liquid using a contacting excess liquid removal device, inasmuch as an amount of excess liquid is preferably substantially the same in each pixel after electrocoagulates have been formed. Moreover, when the non-marking ink is either a dispersion of colorless or unpigmented particles, or alternatively when the non-marking ink is made of a preferably colorless or unpigmented electrocoagulable material, transfer of the corresponding liquid-depleted ink-jet-ink-derived material to a receiver or to another member is advantageously more uniform and more complete. As a result of such more uniform transfer, a resulting image on a receiver will have superior gloss characteristics after fusing, thereby providing a customer with more attractive prints.